

Characterizing the adoption of low-grade hardwood lumber by the secondary wood processing industry

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Abstract

This study investigated the adoption of low-grade lumber in the secondary hardwood industry. Factors influencing decisions regarding the utilization of low-grade lumber were identified and value-added opportunities to increase the use of low-grade lumber among manufacturers currently using higher grades were evaluated. Data were collected via a nationwide mail survey of secondary hardwood manufacturers. The single most important barrier to the adoption of low-grade lumber among secondary hardwood manufacturers is "low yield." Larger manufacturers and trade association members were found to utilize the lower grades at higher percentages when compared to smaller manufacturers and non-members. Value-added activities designed to enhance the useability of low-grade lumber should focus on decreasing processing variability in secondary operations.

Finding sources of raw material (lumber) that suit individual product and processing needs, i.e., the right grade, color, lengths, widths, and degree of value-added, is becoming increasingly challenging for secondary hardwood manufacturers. The simplest solution would be to purchase only the highest grades of lumber available; however, due to the higher prices and limited availability of upper grades, this is not a feasible option for most manufacturers. As a result, manufacturers are considering switching to a lower lumber grade mix to reduce costs and secure adequate supplies of raw materials. A lack of knowledge concerning the potential of lower grade lumber could deter many production managers from considering switching to a

lower grade mix and result in slow adoption of this material. As an example, lack of information regarding obtainable yield may prevent many operations from attempting to integrate more low-grade lumber in their operations (Flowers 1990).

Today, most dimension, flooring, and cabinet mills are designed to process the higher grades of lumber with high yield in usable material and little waste (Gatchell 1993). The traditional rough-mill layout is a crosscut-first operation. But, in recent years the gang-rip first system, which is usually more automated, has become the preferred processing system (Buehlmann et al. 1998, Gatchell 1987).

While National Hardwood Lumber Association (NHLA) grading rules are effective and necessary in establishing a basis for lumber valuation and trading, it is assumed that in some cases a specific grade category might serve as a barrier to low-grade lumber utilization in secondary hardwood industries. For example, the suggested yield difference between the upper and lower grades is not always actualized when processing lumber in the rough mill. In addition, yield

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reducing edging and trimming practices at the sawmills, which are done to upgrade boards, could eliminate material that might be usable in the secondary manufacturing mill thus reducing overall yield. Kline et al. (1993) confirmed that a substantial volume of clear area, which could be used in the production of furniture and cabinets parts, is lost when edging and trimming at the sawmill in order to remove wane. Results of this study revealed that cutting volume was found to increase by 25 percent, and the cost of cuttings was found to decrease by 8 percent when processing un-edged and un-trimmed boards compared to traditional edged and trimmed boards (Kline et al. 1993).

Another barrier to consider regarding utilization of lower grades of lumber is firm innovativeness. Gatchell (1987) stated that habit and tradition are sometimes responsible for the preferred use of the higher grades of lumber and the subsequent refusal to use the lower grades. While innovativeness might be seen as a subjective measure, West and Sinclair (1992) found that "innovators" differed significantly from "non-innovators" according to firm size. More specifically, large firms were found to be more innovative than small companies. In addition, it is often assumed that companies which are members of trade associations display more innovative behavior than non-members (Cumbo 1999).

Objectives

The goal of this study was to better understand the factors affecting the adoption of lower grades of hardwood lumber by secondary manufacturers. Specifically, the study evaluated factors affecting decisions to utilize low-grade lumber. The specific objectives were:

1. to identify barriers to the use of lower grades of hardwood lumber among those secondary wood products manufacturers which currently use middle to high grades of lumber, and
2. to identify opportunities to increase low-grade lumber utilization among secondary hardwood manufacturers.

Methods

Sample development

The population of interest for this study was the secondary hardwood industry which included the flooring, dimension, furniture, and cabinet industries. The sample frame was created us-

ing the American Business Disc 2001 (Info USA Inc. 2001) and web-based member lists of associations representing the four industries. Individual companies were randomly selected from the various lists according to product category, i.e., flooring, dimension, furniture, and cabinets. A total of 1,931 questionnaires were mailed to the sample frame in the following manner: 500 questionnaires were sent to the cabinet industry, 500 to the dimension industry, 431 to the flooring industry, and 500 to the furniture industry. The sample size of the flooring industry exceeded the actual size of the industry, but it was impossible to determine which of the collected addresses did not belong to the sample. All 431 questionnaires were mailed, since a qualifying question in the survey prevented the inclusion of any companies not belonging to the addressed industries.

Due to easier access to information and a higher innovativeness of trade-association members (Cumbo et al. 2001a), it was possible that companies in associations might have a different attitude toward low-grade lumber than non-members. Therefore, ideally one-half of the surveyed companies should be members of major trade organizations, one-half not. Unfortunately not all associations have 250 members; therefore, it was decided that if the association had less than 250 members, all association members were chosen and more than 250 non-members were randomly selected from the non-member sample frame. In the flooring industry, the number of association members exceeded 250, while the number of non-members was below 250. Hence all members and non-members in the flooring industry were included in the sample. The distribution between members and non-members in the final sample was as follows:

- Cabinet industry: 341 randomly chosen non-members, all 159 Kitchen Cabinet Manufacturers Association (KCMA) members;
- Dimension industry: 374 randomly chosen non-members, all 126 Wood Components Manufacturers Association (WCMA) members;
- Flooring industry: all 163 non-members, all 268 NOFMA: The Wood Flooring Manufacturers Association, Maple Flooring Manufacturers Association

(MFMA), and National Wood Flooring Association (NWFA) members, that comply to the above described rules;

- Furniture: 250 randomly chosen non-members, 250 randomly chosen American Furniture Manufacturers Association (AFMA) members that comply with the above described rules.

Questionnaire outline

The questionnaire started with two qualifying questions to properly identify the market segments. In addition, the questionnaire contained five sections addressing the research-subject: "Hardwood Raw Materials Used", "Low-Grade Lumber", "Processing Technology", "Company Demographics", and "Comments and Suggestions". In order to encourage the addressee to respond, the questionnaire began with simple questions before moving on to more complicated questions in the middle of the questionnaire.

The questions in the first section were designed to determine the amount and type of raw material used. It asked the annual hardwood lumber input, as well as the type, species, and grade of hardwood lumber processed. The low-grade lumber section was the core section of the questionnaire. Questions asked for the company's definition of low-grade lumber and if the company experienced a change in low-grade lumber consumption in the past five years. Furthermore, this section addressed the experienced importance of specific barriers to the use of lower grades of lumber and opportunities to overcome these barriers. Two questions asked what could increase the use of low-grade lumber: the first question addressed barriers lying in the lumber itself, the operation, or the product; the second question asked about the perceived importance of value-added activities regarding low-grade lumber performed by sawmills. Questions about processing technology tried to identify the cutting order, processing technology, and yield considering the respondent's operation. Company demographics were designed to enable an estimate of the company size (in terms of sales and employees) and to understand if the company was a member of any trade association. In the last section of the questionnaire open-ended questions allowed the respondent to include other barriers

to utilizing low-grade lumber and to share any other concerns regarding low-grade lumber.

Data collection

A mail questionnaire was used to collect data from the sample frame. Identical questionnaires were sent to all four segments of the population. Members of the Department of Wood Science and Forest Products faculty at Virginia Tech and the USDA Forest Service reviewed the questionnaire prior to pre-testing in the industry. The questionnaire was further revised based on comments received from the pre-test. After final adjustments were made, the questionnaires were mailed in February 2002.

A total of 420 responses were received with 346 usable responses, addressing a company involved in the production of cabinets, dimension parts/components, flooring, furniture, and other wood products. This resulted in an overall response rate of 17.9 percent. A total of 214 questionnaires were returned as undeliverable, and 74 questionnaires were received from companies not involved in the production of wood products.

The overall adjusted response rate was calculated at 21.1 percent. The overall response rates for every industry group were 19.0 percent for the cabinet industry, 15.6 percent for the dimension industry, 12.5 percent for the flooring industry, and 17.8 percent for the furniture industry. The adjusted response rate for each industry segment was calculated as follows: 20.9 percent for the cabinet industry, 18.8 percent for the dimension industry, 15.5 percent for the flooring industry, and 20.3 percent for the furniture industry.

Data analysis

The returned questionnaires were analyzed using Microsoft Excel and the SPSS statistical analysis software package. Summary statistics such as means, frequencies, and cross-tabulations were used to analyze nominal and categorical data such as demographic information. The analysis was done on a 95 percent confidence level, which implies an α -level of 0.05. In order to make comparisons based on the lumber grades used, companies were stratified according to type of lumber grade used. The categories for comparison purposes were:

1. "higher grade users",
2. "middle grade users", and

3. "lower grade users".

Companies in which a plurality (the largest percentage use) of lumber consumption occurred in the FAS and Selects grades were categorized as "high-grade users". Manufacturers using the highest percentage of No. 1 Common lumber were classified as "middle-grade users". Companies using a plurality of lumber consumption in the No. 2 Common, No. 3A Common, and No. 3B Common categories were labeled "lower grade users". Companies providing no data and a companies that did not display a clear majority were not classified and not used in the analysis. The same was true for manufacturers whose majority of lumber consumption did not occur in the NHLA grades.

Results

Non-response bias

Whenever a response rate of less than 100 percent is achieved, there is potential for bias, i.e., the validity of results could be compromised by bias among survey respondents. Therefore, non-response bias tests are necessary to ensure that survey respondents do not differ statistically from non-respondents. Two different types of non-response bias tests were conducted. The student's "t" test was used to test the means of the two samples at a significance level of 0.05.

A telephone survey of non-respondents was performed. Ten companies in each industry sector were contacted and asked a series of questions selected from the questionnaire. Questions 1, 3, and 11 were chosen. Question 1 asked about the main product produced at the facility; question 3 inquired about the annual hardwood lumber input volume at the production facility; and question 11 asked for a rating of several variables regarding the company's decision not to use more low-grade lumber. In order to keep the telephone interview short, only 6 out of 12 variables were used. These included "low yield", "increased waste", "low machine productivity", "more rework", "uniformity is too low", and "too many drying problems (warp, crook, ...)".

No differences in lumber input could be found in the cabinet, dimension, flooring, and upholstered furniture industries. However, the mean lumber input of respondents in the household and office furniture was larger than that of non-

respondents. This indicates that the results could be biased toward larger companies in the household and office furniture industry. A comparison of the rating of variables regarding the company's decision not to use more low-grade lumber showed no differences between respondents and non-respondents.

Another method to check non-response bias is to evaluate differences between early and late respondents. The answers between the first and last ten companies in each industry segment responding to the questionnaire were compared. Questions 3, 11, and 14 were chosen and a t-test at 95-percent confidence level was executed. The comparison of early and late respondents indicated no difference in average lumber input in the dimension, flooring, upholstered furniture, and household and office furniture industries. Nevertheless, early respondents in the cabinet industry showed a larger average lumber input than late respondents. Therefore, the results of this study could be biased toward larger companies in the cabinet industry. When the rating of variables regarding the company's decision not to use more low-grade lumber are compared between early and late respondents, the following significant differences are found:

- In the cabinet industry late respondents rate the increase in non-value adding steps in the process as a significantly higher barrier than early respondents.
- In the dimension industry the limited kiln-dryer capacity is ranked higher by late respondents than by early respondents.
- Early responding flooring manufacturers indicate low uniformity, poor processing predictability, poor load-to-load consistency, and high costs of the parts produced as significantly more important than late respondents.
- In the upholstered furniture industry no differences in the rating could be established.
- In the household and office furniture industry late respondents rate poor processing predictability, and increase in non-value adding steps in the process higher than early respondents.

No differences in yield between early and late respondents could be found in any industry segment.

It is surprising that the comparison between respondents and non-respondents and the comparison between early and late respondents show different results. This can be interpreted in two ways: there is either only a bias when both tests indicate one or there is a bias whenever one of the two different tests signifies one. In the first case this study would not be biased; in the second case this study indicates bias toward larger cabinet and household manufacturers. Readers must take into account this information when interpreting the data and results.

Lumber consumption

The mean annual lumber input over all industry segments was calculated at approximately 3.69 million board feet (MMBF). **Figure 1** shows the mean annual lumber input for the flooring and dimension industries calculated at approximately 11.1 MMBF and 3.79 MMBF, respectively. The household and office furniture and upholstered furniture segments consumed, on average, approximately 2.18 MMBF and 976,000 board feet (BF), respectively, in 2001. Average annual lumber input among respondents from the cabinet sector was calculated at approximately 955,000 BF. It should be noted that lumber consumption values reported for the furniture and cabinet sectors indicate that the sample may be skewed toward smaller manufacturers (Cumbo 1999, Olah et al. 2000).

The study also revealed variation in the grades of lumber used according to industry sector. Specifically, the flooring and upholstered furniture industry was identified as low-grade lumber users. Both utilized low-grade lumber at larger percentages than the other industry segments surveyed. The flooring industry utilized a larger percentage of No. 2 Common lumber when compared to the remaining industry segments, while the upholstered furniture industry consumed a larger percentage of No. 3A Common than all other manufacturers surveyed (**Table 1**). The research identified that 3.3 percent of the low-grade lumber consumption (No. 2 Common, No. 3A Common, and No. 3B Common) evaluated occurs in the cabinet industry, 11.9 percent in the dimension industry, and 77.6 percent in the flooring industry. Another 3.3 percent of the low-grade lumber was consumed by the upholstered furniture industry, while the household and office furniture industry

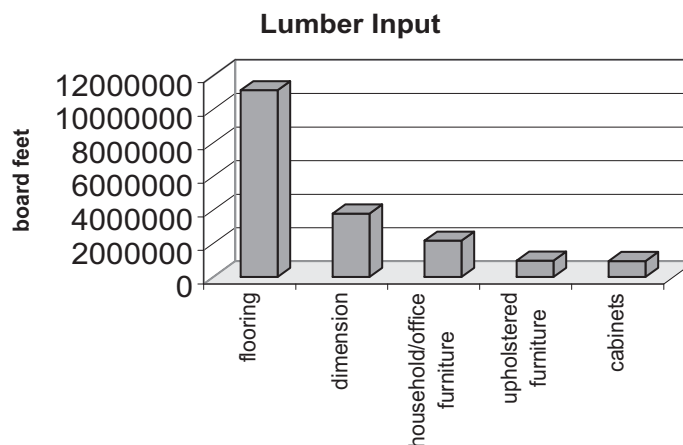


Figure 1. — Mean lumber consumption by responding industry segment.

Table 1. — Percentage of lumber grade use by market segment.

Lumber grade	Percentage of lumber grade used by segment					Overall
	Cabinets	Dimension	Flooring	Upholstered furniture	Household and office furniture	
	----- (%) -----					
FAS	7.1	19.9	2.1	0.6	11.0	8.0
Selects	5.9	6.3	0.5	0.9	5.9	3.0
No. 1 Common	64.1	47.7	9.7	5.3	64.1	29.6
No. 2 Common	20.6	21.2	48.0	13.2	16.5	34.8
No. 3A	0.5	2.8	26.3	66.8	1.7	16.5
No. 3B	0.2	1.4	2.1	4.2	0.0	1.5
Cants	0.0	~0	0.0	0.0	0.0	~0
Ungraded lumber	~0	0.1	0.2	8.0	0.3	0.3
Proprietary grades	~0	0.1	2.8	0.0	0.5	1.6
Other	1.6	0.5	8.3	1.0	0.0	4.7
Sum	100	100	100	100	100	100

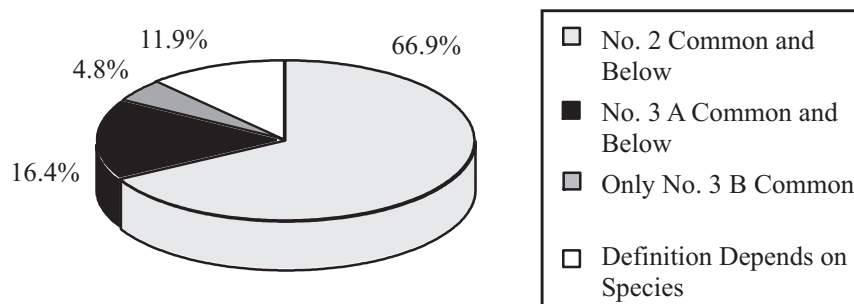


Figure 2. — Percentage of respondents who defined "low grade" by category.

used 3.9 percent of the total low-grade lumber.

Study participants were also asked to describe what is considered low-grade hardwood lumber at their company. The majority (nearly 67%) of respondents defined "low-grade" as No. 2 Common and below. No. 3A Common

and below was considered "low-grade" by approximately 16 percent of the respondents, while nearly 5 percent defined "low-grade" as No. 3B Common lumber. This is why 3A and 3B were separately reported. Nearly 12 percent indicated that the definition for "low-grade hardwood lumber" depended on the species (**Fig. 2**).

Companies were categorized reflecting where most of their lumber grade use occurred. This research found that 112 (32.4%) of the manufacturers were categorized as upper grade users (FAS and Selects), 85 (24.6%) were middle grade users (No. 1 Common), while 61 (17.6%) were lower grade (No. 2 Common and below) users. These categories were determined by the respondent's classification of low-grade in the earlier question. Also, 88 (25.4%) manufacturers could not be identified in any one of the three groups due to that they did not show a majority of lumber consumption in one category or did not make their lumber grade pattern available (**Fig. 3**). This group of companies was not used in the analysis.

When asked, if the company increased its low-grade lumber consumption during the past five years the majority (66.9%) answered with "no". Only 24.3 percent showed an increase in the utilization of low-grade material, while 8.8 percent decreased their low-grade lumber use. In the cabinet industry 72.9 percent of the manufacturers did not change their low-grade lumber consumption, 17.7 percent increased it, and 9.4 percent decreased it. The majority (62.5%) of the dimension manufacturers did not change their grade mix, 30.6 percent increased the low-grade lumber utilization, while 6.9 percent decreased it. In the flooring industry, 52.9 percent of the producers did not show any change, while 47.1 percent had a growing low-grade lumber consumption. No flooring manufacturer reduced the low-grade lumber use. The majority (70.9%) of the upholstered furniture industry did not change their grade-mix, 8.3 percent increased their low-grade lumber utilization, and 20.8 percent cut down the low-grade lumber use. The high percentage of manufacturers that reduced their low-grade lumber consumption is probably due to an increased use of engineered wood, which replaces low-grade lumber. In the household and office furniture industry, 75.0 percent did not change their grade mix toward the lower grades, 11.5 percent increased, and 13.5 percent decreased the low-grade lumber utilization (**Table 2**).

Barriers to the use of lower grades of hardwood lumber

Manufacturers were asked to rate 12 variables regarding the importance in the company's decision not to use more

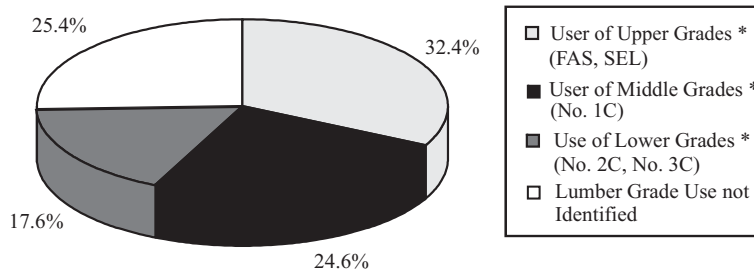


Figure 3. — Percentage of the types of lumber grade used by respondents.

Table 2. — Percentage change in low-grade lumber consumption by industry segment.

Change	Response frequency				
	Cabinets	Dimension	Flooring	Upholstered furniture	Household and office furniture
	----- (%) -----				
No change	72.9	62.5	52.9	70.9	75.0
Increased	17.7	30.6	47.1	8.3	11.5
Decreased	9.4	6.9	0.0	20.8	13.5
Sum	100	100	100	100	100

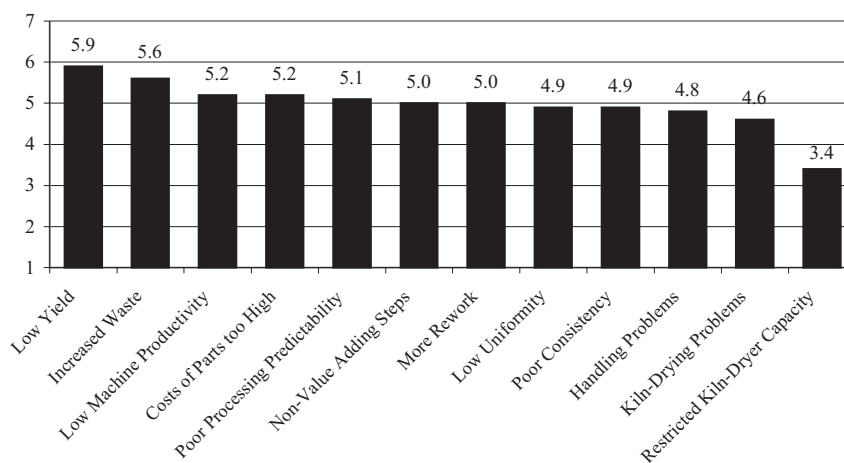


Figure 4. — Mean importance ratings of 12 barriers to low-grade lumber utilization.

low-grade lumber (**Fig. 4**). The scale used for the rating ranged from 1 to 7, with 1 being "unimportant", 4 "average importance", and 7 "very important". The highest rated barrier was "low yield" with a mean of 5.9 followed by "increased waste" with a mean rating of 5.6. Conversely, the two least important barriers were related to the drying process: "too many kiln-drying problems", e.g., warp, crook, etc., received a mean rating of 4.6 and "not enough kiln-dryer capacity to utilize low-grade lumber", i.e., must dry more to get the desired

amount of usable material, was rated at 3.4. In addition, at the 95 percent confidence level, Analysis of Variance (ANOVA) was used to identify statistical differences that were detected between the various types of lumber grade users (**Table 3**). Ratings of the following variables: "increased handling problems", "uniformity is to low", and "processing predictability is poor" differed among the lumber grade user categories (*p*-values 0.01, < 0.01, and < 0.01, respectively). In all cases, the users of upper grades rated the variables higher.

Table 3. — Mean rating of low-grade lumber barriers by type of lumber grade consumer.^a

Variable	Rating ^b			Total	p-value
	User of upper grades (FAS, SEL) n = 112	User of middle grade (No. 1C) n = 85	User of lower grades (No. 2C, No. 3C) n = 61		
	$\bar{(x)}$				
Low yield	5.9	5.9	6.2	5.9	0.41
Increased waste	5.7	5.3	5.5	5.6	0.30
Processing predictability is poor	5.5	5.0	4.6	5.1	0.005 ^c
Uniformity is too low	5.4	4.9	4.1	4.9	< 0.01 ^c
Increase in non-value adding steps in the process	5.3	5.1	4.7	5.0	0.13
More rework	5.2	5.0	4.6	5.0	0.13
Increased handling problems	5.2	4.6	4.4	4.8	0.01 ^c
Load-to-load consistency is poor	5.1	4.9	4.6	4.9	0.30
Costs of the parts produced are too high	5.0	5.3	5.2	5.2	0.55
Low machine productivity	5.0	5.4	5.3	5.2	0.34
Too many kiln-drying problems	4.7	4.8	4.3	4.6	0.43
Not enough kiln-dryer capacity	3.3	4.0	3.1	3.4	0.07

^a Type of lumber grade user refers to majority of lumber grade use; lumber grade use is not limited to the grade category.

^b Rating scale is 1 to 7 with 1 being unimportant and 7 very important.

^c Significant differences between the groups.

Firm size

Twenty-seven percent of the manufacturers reported annual sales below \$1,000,000, 25.9 percent indicated sales between \$1,000,000 and \$5,000,000, and 18.4 percent sell between \$5,000,001 and \$15,000,000 yearly. Only 5.7 percent of the companies had total gross sales between \$15,000,001 and \$25,000,000, 7.8 percent between \$25,000,001 and \$50,000,000, while 15.2 percent of the respondents reported sales exceeding \$50,000,000.

Cross tabulations were used to determine if a relation exists between company size (in terms of total gross sales) and the lumber grades bought. It was found that the majority of upper grade users (50.5%) were companies with sales less than \$1,000,000 annually. The plurality of middle grade users (22.2%) were companies with total gross sales between \$1,000,000 and \$5,000,000. The plurality of lower grade users (29.1%) were companies with annual sales between \$5,000,001 and \$15,000,000.

Trade association membership

Results of the data showed that 65.8 percent of the respondents were associa-

tion members, while 34.2 percent were non-members. Likewise, 43.4 percent of the companies were identified as upper grade users, 33.0 percent middle grade users, and 23.6 percent lower grade users. A possible connection between the lumber grades bought and the membership in a trade association was examined with cross tabulations. The majority of the upper grade users (56.8%) were not association members, while the majority of the middle grade users (81.7%), as well as the majority of the lower grade users (80.0%) represent association members. The plurality of association members (41.2%) were middle grade users, while the majority of non-members (70.0%) were upper grade users.

Rough-mill layout

Today, the majority of secondary hardwood manufacturers use some form of rip-first operation; either gang-rip, straight-line-rip, or a gang-rip operation with an optional crosscut saw for crooked boards. Rough-mill layout differs somewhat depending on the industry sector. It was found in the household and office furniture industry that a higher percentage of manufacturers use

a crosscut operation compared to the cabinet, dimension, and flooring industries. Likewise, the upholstered furniture industry uses the crosscut cutting sequence in a higher percentage when compared to the flooring industry.

Only 8.1 percent of the respondents indicated they would consider using more low-grade lumber if their rough-mill layout was different. In the cabinet industry, 3.2 percent of the cabinet manufacturers saw their rough-mill layout as a barrier to utilizing low-grade lumber, while 12.8 percent of the dimension producing operations thought of it as a barrier. The percentages of companies in the flooring, upholstered furniture, and household and office furniture industry that experience their rough-mill layout as a barrier were 9.3 percent, 3.7 percent, and 14.5 percent, respectively. This indicates that the vast majority of companies do not think that the rough-mill layout could represent a problem when an increase in low-grade lumber consumption is desired.

On the other hand, the results of this study showed that the lower grades were mainly consumed in rip-first operations, while the upper grades were primarily used in crosscut-first operations. Cross-tabulation was used to sum the cutting order in connection with the lumber grade used; the majority of the upper grades (50.5%) were consumed in crosscut-first operations, while the plurality of the middle grades (48.6%) and the majority of the lower grades (66.7%) were used in rip-first operations. Cross-cut-first operations consume mainly (56.1%) upper grades, rip first operations do not show a distinct plurality, and rip-first operations with an optional crook removing crosscut saw consume mainly (52.2%) the middle grades (Table 4).

Grading rules

Approximately 20 percent of all respondents indicated that they would consider increasing consumption of low-grade lumber if the lumber was custom graded. By industry sector, 20 percent of cabinet manufacturers, 26 percent of the dimension manufacturers, 30 percent of flooring manufacturers, 22 percent of upholstered furniture manufacturers, and 16 percent of household and office furniture manufacturers indicated that custom grading would be an important factor in increasing their consumption of low-grade lumber.

Table 4. — Comparison of rough-mill type to grade user.

Type of lumber grade user ^a	Cutting order			Total (n)
	Crosscut-first (n)	Rip-first (n)	(Crook-crosscut) Rip-first (n)	
Upper grade user (FAS, SEL)	46	41	4	91
Middle grade user (No. 1C)	25	35	12	72
Lower grade user (No. 2C, No. 3C)	11	36	7	54
Total	82	112	23	217
Raw percentages (%)				
Upper grade user (FAS, SEL)	21.2	18.9	1.8	41.9
Middle grade user (No. 1C)	11.5	16.1	5.5	33.2
Lower grade user (No. 2C, No. 3C)	5.1	16.6	3.2	24.9
Total	37.8	51.6	10.6	100
Row percentages (%)				
Upper grade user (FAS, SEL)	50.5	45.1	4.4	100
Middle grade user (No. 1C)	34.7	48.6	16.7	100
Lower grade user (No. 2C, No. 3C)	20.3	66.7	13.0	100
Total	37.8	51.6	10.6	100
Column percentages (%)				
Upper grade user (FAS, SEL)	56.1	36.6	17.4	41.9
Middle grade user (No. 1C)	30.5	31.3	52.2	33.2
Lower grade user (No. 2C, No. 3C)	13.4	32.1	30.4	24.9
Total	100	100	100	100

^a Type of lumber grade user refers to plurality of lumber grade use; lumber grade use is not limited to the grade category.

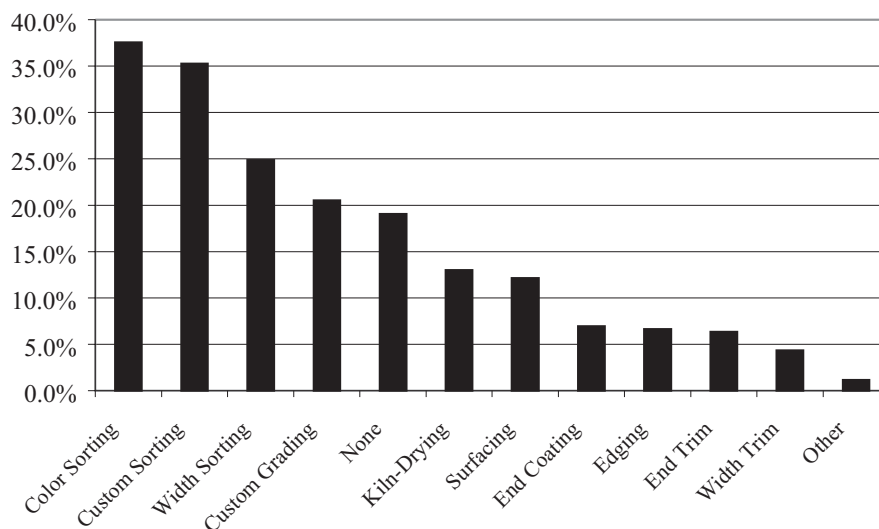


Figure 5. — Percentage of respondents who indicated these value-added activities could influence their low-grade lumber utilization.

Respondents were also asked to indicate which value-added activities would make low-grade lumber more attractive to them. Twenty-one percent cited custom grading as an important value-added activity. By industry sector, 20 percent of cabinet manufacturers, 23 percent of dimension manufacturers, 30 percent of the flooring manufacturers,

26 percent of upholstered furniture, and approximately 18 percent of household and office furniture manufacturers cited custom grading. Overall, “custom-grading” was the fourth most frequently cited of a total of 12 factors. Custom grading was found to be less important than color sorting, custom sorting, and width sorting only (Fig. 5).

Factors affecting increased utilization of lower grades of hardwood lumber

In order to identify opportunities to increase the utilization of low-grade lumber, secondary manufacturers were asked under which circumstances they would consider using more low-grade lumber in their operation. The respondents were asked to check, from a list, all factors that apply. Over 46 percent of respondents indicated that they would increase their low-grade lumber consumption if higher yield in cuttings were possible, approximately 42 percent would consider it if customers would accept products with more characteristics. Comparatively, 20 percent would consume more low-grade material if its cost was lower, and 8 percent would utilize more low-grade lumber if their rough-mill layout was different (Fig. 6).

Similarly, secondary manufacturers were asked which value-added activities at the sawmill would make low-grade lumber more attractive for their operation. Again, respondents were asked to check all that apply. The most important value-added activities supporting usage of low-grade lumber were color sorting (38%), followed by custom sorting (35%), width sorting (25%), and custom grading (21%). Less important activities included edging (7%), end trimming (6%), and width trimming (4.3%) (Fig. 5).

Alignment between primary and secondary hardwood manufacturers

A prior study, conducted by the Center for Forest Products Marketing and Management at Virginia Tech, examined issues related to low-grade hardwood lumber in the hardwood sawmill industry (Cumbo et al. 2001b). Primary manufacturers were asked various questions regarding low-grade lumber. Two of these questions were similar to questions asked in this study, thus results can be compared. The questions addressed were:

1. the definition of “low-grade” and
2. value-added activities regarding low-grade lumber.

Considering that primary and secondary manufacturers sometimes represent direct supplier customer links in the hardwood value chain, alignment of supplier

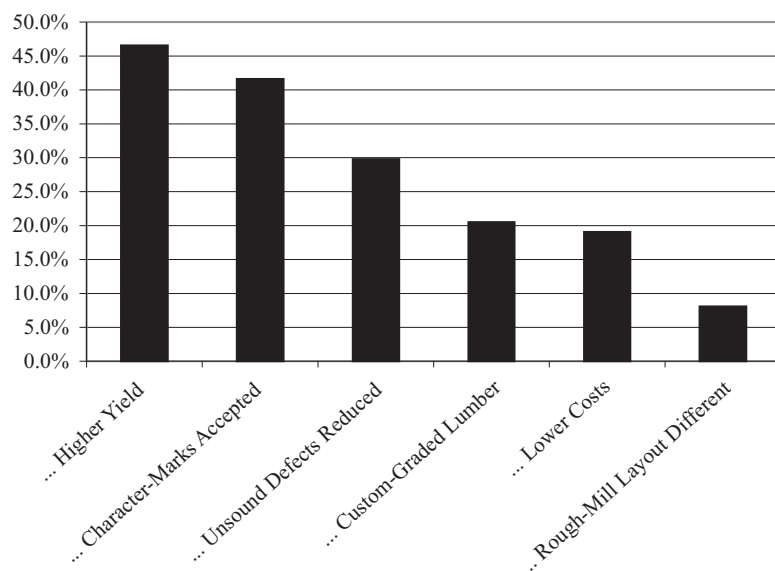


Figure 6. — Percentage of respondents who indicated these factors influenced increased low-grade lumber utilization.

Table 5. — Comparison of “low-grade” definition, hardwood sawmills to secondary industry.

Definition for low-grade hardwood lumber	Response frequency	
	Hardwood sawmills ^a	Secondary manufacturers
	----- (%) -----	
No. 2 Common and below	40.2	75.9
No. 3A and below	37.0	18.6
No. 3B only	22.8	5.5
Total	100	100

^a Cumbo et al. 2001b.

Table 6. — Comparison of value-added currently performed at sawmills versus value-added influencing increased utilization of low-grade lumber.

Value-added activities for low-grade lumber	Response frequency ^a	
	Hardwood sawmills offer ^b	Secondary manufacturers would appreciate
	----- (%) -----	
Custom sorting	49.8	35.3
End coating	21.9	6.9
Surfacing	25.9	12.1
Edging	23.1	6.6
Kiln-drying	23.5	13.0
Custom grading	23.1	20.5
None	23.1	19.1
Other	4.0	1.2

^a Several answers were possible.

^b Cumbo et al. 2001b.

capabilities and customer requirements is important to the success of both sides.

It was found what is meant by the term “low-grade” differed between pri-

mary and secondary manufacturers. Specifically, the vast majority of secondary manufacturers perceived low-grade as No. 2 Common and below,

while a majority of primary manufacturers categorized No. 2 Common lumber as “middle grade” (Table 5).

The second question, used in comparing the study results, relates to value-added activities for low-grade lumber. The range of possible responses differed slightly between the two studies. There appears to be alignment between those value-added activities that sawmills currently perform and those that secondary manufacturers require in the areas of custom sorting and custom grading (Table 6).

Discussion and conclusions

These results indicate opportunities for low-grade lumber utilization by the secondary hardwood industry. First, yield is important. However, while lower grades should not be expected to yield at the same level as upper grades, there may be specific parts and/or products for which low-grade is a feasible raw material, from a cost/yield perspective. Increased consumer acceptance of products such as character-marked furniture, cabinets, and flooring could significantly impact the feasibility of utilizing lower grades of lumber. In today’s increasingly complex and diversified markets, customers are more knowledgeable and, therefore, more specific in their demands. For example, various lumber sorts and custom grading are becoming more of an expectation for some customers rather than special product features. However, many sawmills have been quite slow to respond to these demands. Assuming these types of value-added activities become commonplace in the industry, it will benefit those who offer them early on and develop the additional processes required to service these new customer needs. These activities could provide opportunities for hardwood producers to differentiate themselves, thereby, increasing overall sales, not just low-grade lumber sales.

Yield was cited most often as the most important factor in considering using more low-grade lumber. Due to the importance of material costs, maximizing yield is a strong area of focus for any rough mill. Next to “yield”, another important factor in considering increased use of low-grade lumber was “customer acceptance of character marks”. It is important to note that yield is not only dependent upon the part volume obtained from raw material, it also dependent upon consistency of color in products

such as exposed furniture and cabinet parts, edge-glued panels, and stair parts. There may be more color variation in the lower grades; therefore, customer acceptance of these inconsistencies could play a major role in increasing yield obtained from lower grades of lumber.

A less important factor in increasing low-grade lumber utilization was rough-mill layout. Study results revealed that, overall, a majority of respondents used a rip-first cutting order; however, household, office, and upholstered furniture manufacturers used crosscut-first in a higher percentage compared to the other sectors surveyed. While rough-mill layout was not considered an imported barrier to low-grade lumber, optimizing gang-rip systems may be seen as an “enabling” technology, which would allow manufacturers to more efficiently process low-grade lumber. In addition, if it is assumed that trade association memberships are comprised mostly of higher volume, more innovative companies, which utilize these “enabling” technologies, it follows that member companies might represent those that are more likely to consider a switch to a lower grade raw material. Therefore, trade association members could represent a potential target audience for marketing low-grade lumber.

When asked to indicate which value-added activity performed by the sawmill would make low-grade lumber a more attractive raw material, respondents cited, in descending order, color sorting, custom sorting, width sorting, and custom grading. Interestingly, the top three activities related, in some way, to reducing within pack or load variability. This

indicates that value can be added to low-grade lumber, from the customer’s perspective, with no additional machine production capacity.

In comparing “upper grade” users to “lower grade” users, on their ratings of the 12 barriers to low-grade lumber utilization, “increased material handling problems”, “lower material uniformity”, and “poor processing predictability” were all rated more important by “upper grade” users. It is clear that among those currently using the higher grades, switching to low-grade lumber results in a less predictable, more cumbersome processes to manage.

It was found that the primary and secondary hardwood industries differ in what is considered “low-grade”. Hardwood sawmills, as expected, perceive the low-grade category to be less encompassing than secondary manufacturers. Most hardwood sawmills define “low-grade” as 3A Common and below, while a large majority of secondary manufacturers define “low-grade” as 2 Common and below.

Finally, there appears to be some misalignment between primary and secondary manufacturers, indicating a lack of communication and understanding of supplier capabilities and customer requirements. Moreover, hardwood sawmills should exploit those value-added possibilities in which alignment was found and work to develop strategies to address those in which there was no alignment between sawmills and secondary manufacturers. It is worth repeating that the top three value-added activities, indicated by secondary manufacturers, related to reducing variability in the raw material.

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